Run II

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meeting with D0

April 24, 2002

The Tevatron Collider Program

Run II

- Much of the accelerator complex is new or rebuilt.
- CDF and D0 were upgraded to operate at the higher luminosity.

Physics of the Weak Energy Scale

- Precise *t*, *W* mass measurements –
- Supersymmetry searches
- Search for new physics: hidden dimensions, strong dynamics, …
- Low-mass Higgs search, in time

CP Violation and Quark Flavors

- B_s mixing to determine V_{ts}
- CP-violating asymmetries

Run IIa Luminosity Goals

- **Run IIa** refers to operations supported by the collider configuration envisioned during the Main Injector construction.
  - Luminosity:
    - 5×10^{31} (Main Injector Project baseline)
    - 8×10^{31} (renormalized when we exceeded our Run I goal by 60%)
    - 2×10^{32} (Recycler Ring incorporated into the Main Injector Project)
  - Integrated luminosity: 2 fb^{-1} over a 2-3 year period

The Collider Run II is the most important activity at Fermilab and gets the most support.

The Distribution of Effort

- The rough fraction of the laboratory personnel costs (SWF) that supports the various research programs:

Program	SWF FY02 Funds ($M)	% of total research
Tevatron Collider	64.7	60
Neutrino Program	8.0	8
LHC	8.5	8
Accelerator R&D	7.6	7
Exp. Astrophysics*	2.0+1.7	2+2
BTeV	3.0	3
CKM	1.4	1
Fixed Target	3.2	3
Theory	4.2	4

***First number is Fermilab funding, second is from outside sources.**

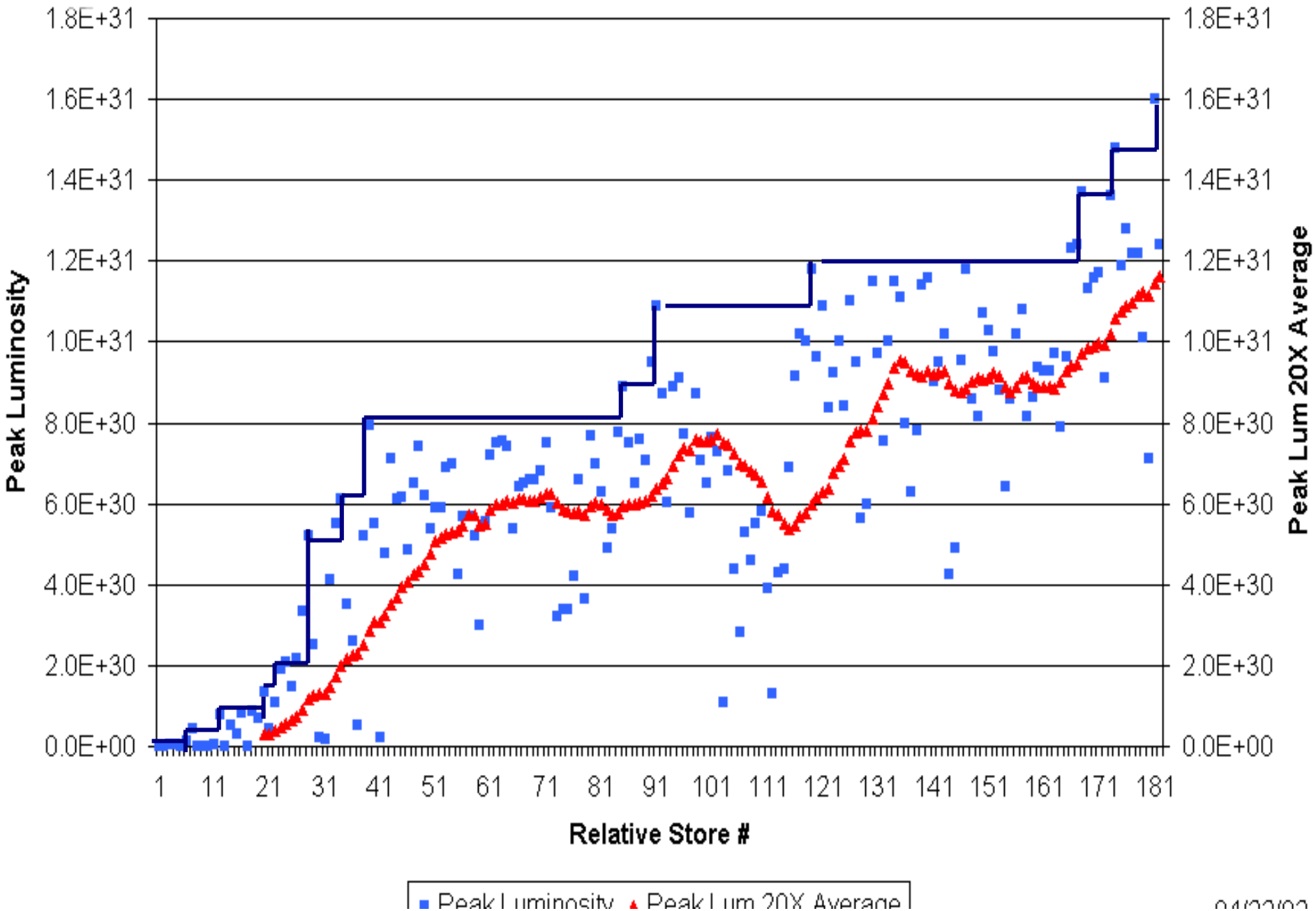
Run II Luminosity

- The Tevatron physics program is the best opportunity we have in the world of particle physics for some time.
  - It is critically important that we deliver as much integrated luminosity as possible over the next several years.
  - We must do this while keeping NuMI, LHC, CMS, MiniBooNE on schedule.

Unfortunately

- The collider performance in Run II is off to a disappointing start.
  - The initial luminosity is typically 1.3 E31, should be 3-4 E31 at this point.
  - Many problems identified; some solutions found; many more to go.
- We are finding ways to bring additional effort to bear on the problems.

Collider Run IIA Peak Luminosity



Luminosity Campaign

- We are in the middle of organizing for a sustained campaign to improve luminosity that will extend for some time.
  - We have centralized the organization under a Deputy Division Head.
  - We will need to reach into every part of the laboratory to get the people we need to support the Tevatron effort.
  - We are also seeking help from other laboratories in places where they have special expertise.
  - We have started to broaden the effort but much more will be done.
  - We are in it for the long haul.

- In FY 2002 the total Fermilab budget increased 3.5%, just enough to sustain constant manpower and effort.
  - We increased the budget for the accelerator effort, including operations and upgrades, by $10 M or 16%.
  - Projects (LHC, CMS, NuMI, MiniBooNE) received scheduled funding.
  - Everything else was cut.

Luminosity Campaign

- A few of the steps taken to date
  - Beams Division has had the ability to hire new accelerator scientists for two years, despite tight limits elsewhere in lab.
    - Competition in hiring and retention is fierce.
    - We hired in 17 new scientists, but lost almost as many to retirement and other accelerator projects.
  - M. Church took on new role as Deputy Beams Division Head with responsibility for directing the effort to improve collider performance. He
    - established a year-long plan for addressing performance issues and is now implementing it.
    - has made lists of tasks useful for talking to the outside world about helping the effort.
    - meets weekly with S. Holmes and others to plan the campaign.

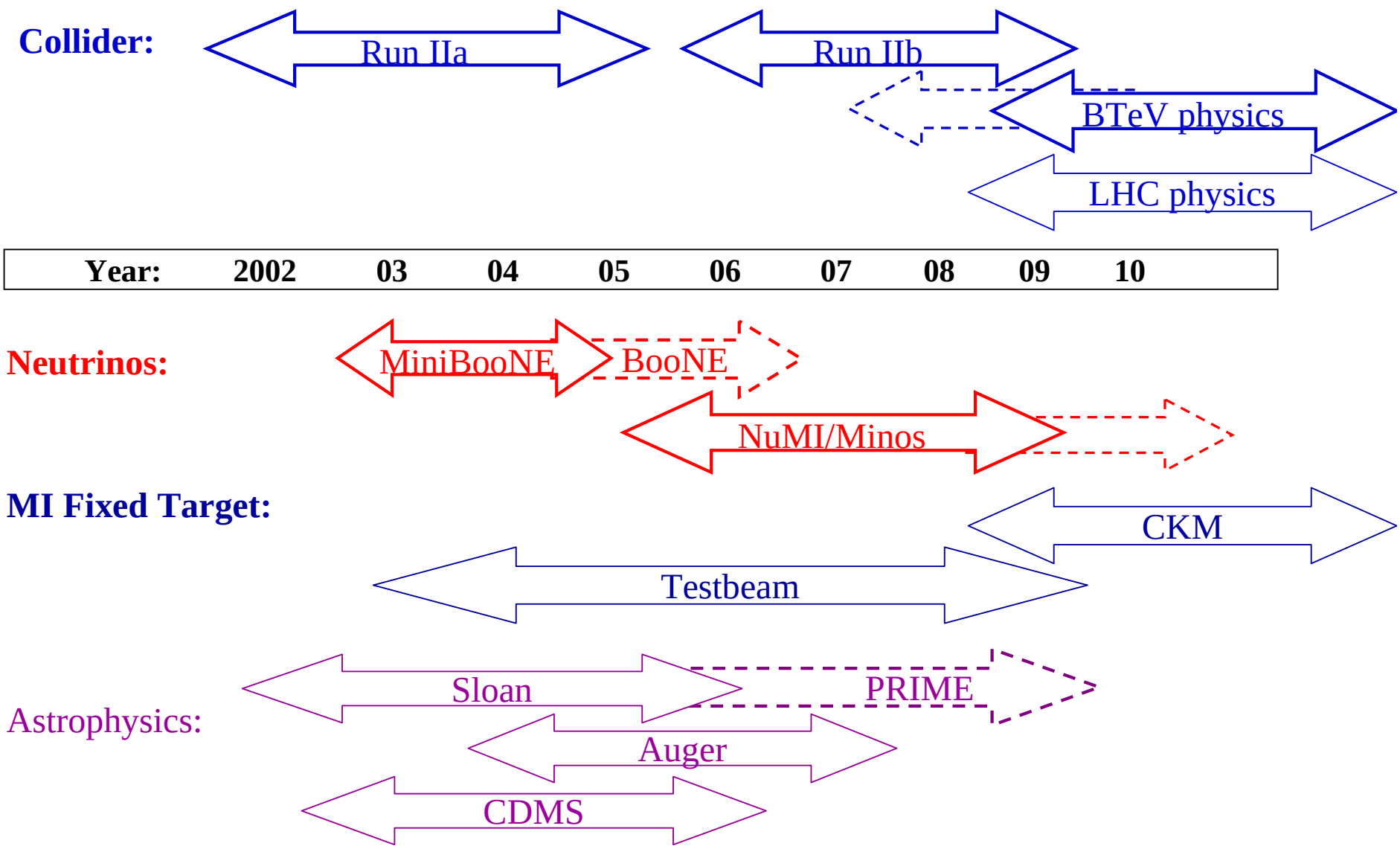
Luminosity Campaign

- The Instrumentation group is being strengthened in BD
  - In addition, Stephen Pordes is being transferred to BD to lead this.
  - Instrumentation tasks will be assigned to appropriate experts throughout the laboratory.
- Some examples of people outside BD already working on tasks important for understanding and improving accelerator performance (not a complete list)
  - Tevatron flying wires — S. Pordes
  - Shot data analysis — P. Lebrun (w/ J. Slaughter, BD)
  - Synch light monitor — H. Cheung and A. Hahn
  - SBD — Alan Hahn
  - Backgrounds — various collaboration members
  - Bunch length/width — various collaboration members
- We need many more such examples and are working to improve the process of recruiting outside help.

Ongoing Construction Projects

- Run 2b Upgrades (2005)
  - Accelerator luminosity
  - Detectors
- Neutrino Projects
  - NuMI/MINOS (2005)
  - MiniBooNE (2002)
- LHC (2005)
  - US LHC Accelerator project
  - US CMS

Fermilab Research Program



Run IIb

- Run IIa represents a big improvement in supersymmetry searches, top and W mass measurements, B physics, and QCD studies.
- Additional luminosity provides greater precision for electroweak measurements, greater reach in searches for new physics, plus the opportunity to observe a low-mass Higgs boson.
- The LHC schedule has slipped twice over the last two years. We now expect the first LHC physics results in 2008.

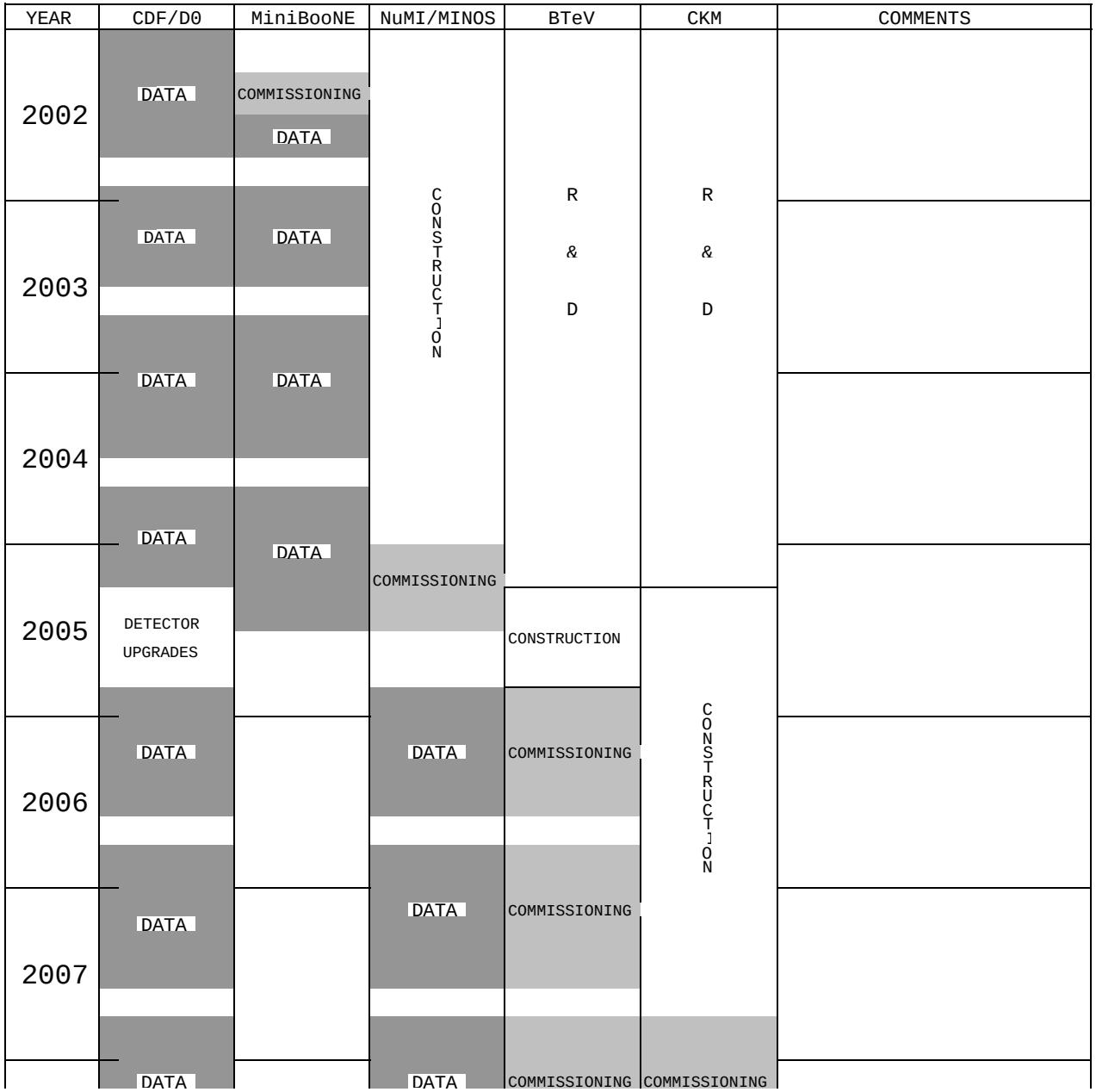
- Accelerator
  - Improve luminosity by factor of 2-3 with a number of modest upgrades.
  - Accelerator advisory committee reviewing progress.
  - Right now, the greatest attention must be concentrated on run IIa, which provides the base for the IIb improvements.

Run IIb

- Detectors
  - Two upgrade projects. For each, the main goals are:
    - Replace silicon detectors that will become radiation-damaged at ~4 fb^{-1} with new detectors of simpler design and more rad-hard technology.
    - Upgrade data acquisition and triggers to deal with higher luminosity.
  - Technical review committee and Temple review committee to help prepare for DOE baseline review.
  - We are preparing to baseline these projects in a new environment for DOE-SC projects.
    - Lehman lecture on new project management order
    - All parts of project and all costs included on project at baseline
    - Adequate contingency and schedule float

CY 2002 - 2009 Schedule

April 1, 2002



Impact of FY 2002 Budget

- The program we described at HEPAP last year required $300 M for FY2002.
- The President's Budget Request would have allocated $291 M.
- The actual FY2002 budget is $286 M.
  - The 3.6% increase is better than HEP as a whole.
  - There are no increases for Run 2b accelerator and detector upgrades and Tevatron maintenance and operations. Room for those must be done by cuts elsewhere.

- To fit within that budget
  - Tevatron program receives amount needed, barely.
  - NuMI, MiniBooNE receive amount planned.
  - Divisions' base budgets and all other programs were cut.
  - M&S spending on successful low-field magnet, neutrino factory R&D programs were zeroed.

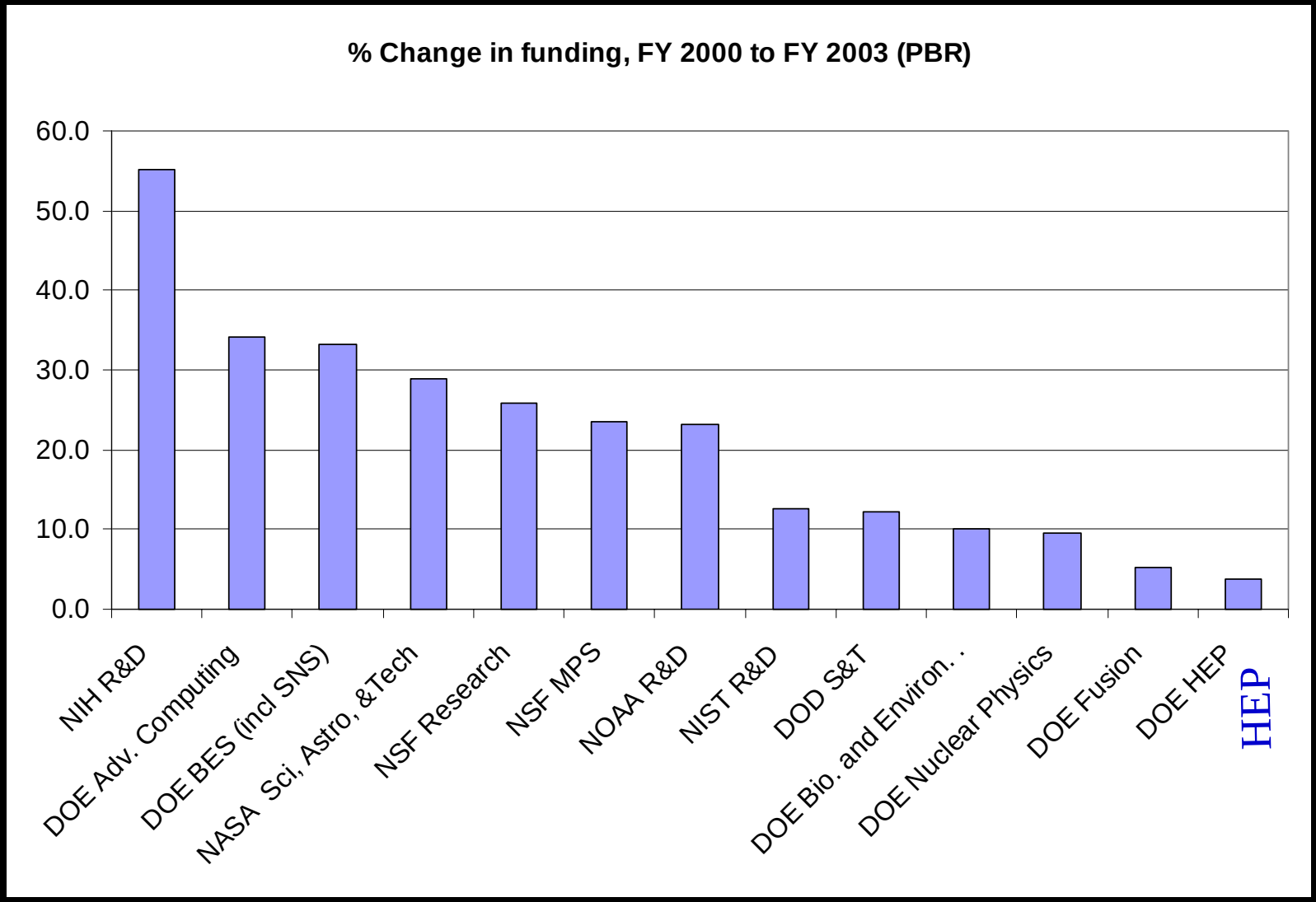
FY 2003 President's Budget Request

	FY2002 Actual ($M)	FY2003 PBR	02-03 Change (%)
Fermilab	286.3	288.7	+0.9
HEP	713.1	725.0	+1.7
Science	3,280.7	3,285.1	0

- I will discuss the impact of this budget on the important parts of the US HEP program at Fermilab.
- The problem at Fermilab cannot be solved without more for HEP.

The scientific future for HEP could be great, but we will not get there with a budget for US High Energy Physics below inflation every year.

The Large Funding Picture, 2000-2003



Summary

- **We have great opportunities ahead.**
- **But we have to improve Tevatron luminosity first.**
  - It is important for the physics now.
  - It is also important for anything else we want to do in the future.